



COMMISSION INTERNATIONALE DE L'ÉCLAIRAGE  
INTERNATIONAL COMMISSION ON ILLUMINATION  
INTERNATIONALE BELEUCHTUNGSKOMMISSION

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## **DIVISION 2 : PHYSICAL MEASUREMENT OF LIGHT AND RADIATION**

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Home Page: <http://cie2.nist.gov>

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# **DIVISION 2 ACTIVITY REPORT May 2006**

May 30, 2006

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## Division Officers

Director: Teresa Goodman  
Associate directors: Georg Sauter  
Nobert Johnson  
Guy Vandermeersch  
Editor Jim Gardner  
Secretary Yoshi Ohno

## Country Members (36 countries: no change from 2005)

AUSTRALIA	Jim Gardner	ITALY	Maria Luisa Rastello
AUSTRIA	Michael Matus	JAPAN	Ichiro Saito
BELGIUM	Etienne Pierson	KOREA	Jin Sang Kwon
BRAZIL	Ana V. de Freitas Silva	NETHERLANDS	Paul Nederpel
BULGARIA	Bojana Florian	NEW ZEALAND	John F. Clare
CANADA	Joanne C. Zwinkels	NORWAY	Tore Kolas
CHINA	Pan Jiangen	POLAND	Jerzy Pietrzykowski
CROATIA	Mrzljak Zeljko	ROMANIA	Mihai Simionescu
CZECH REPUBLIC	Smid Marek	RUSSIA	Raissa Stolyarevskaya
DENMARK	Poul Erik Pedersen	SLOVENIA	Stanko Erste
FINLAND	Erkki Ikonen	SOUTH AFRICA	Franz Hengstberger*
FRANCE	Jean Bastie	SPAIN	Antonio Corrons
GERMANY	Georg Sauter	SWEDEN	Allan Ottosson
GREAT BRITAIN	Teresa M. Goodman	SWITZERLAND	Peter Blattner
HONG KONG	T. M. Chung	THAILAND	Surapol Vatanawong
HUNGARY	Gyula Dézsi	TURKEY	Kamuran Turkoglu*
INDIA	V.D.P. Sastri	USA	Norbert Johnson
ISRAEL	Dan Scheffer	YUGOSLAVIA	Predrag Vukadin

Changes since May 2005:

Turkey representative changed from Ozturk, Apr. 2006.

South Africa representative changed from Botha, March 2006.

## Current Technical Committees

May 2006

	Technical Committee	Chair	AD
	TC2-16 Characterization of the Performance of Tristimulus Colorimeters	J Schanda	S
	TC2-17 Recommendation for Integrated Irradiance and Spectral Distribution of Simulated Solar Radiation	G Zerlaut	J
	TC2-19 Measurement of the Spectral Coefficient of Retroreflection	N Johnson	J
	TC2-23 Photometry of Street-Lighting Luminaires	G Vandermeersch	V
	TC2-25 Calibration Methods and Photoluminescent Standard for Total Radiance Factor Measurement	J Zwinkels	J
	TC2-28 Methods of Characterizing Spectrophotometers	M Pointer	J
	TC2-29 Measurement of Detector Linearity	T Larason	S
	TC2-32 Measuring Retroreflectance of Wet Horizontal Road Markings	N Hodson	J
	TC2-37 Photometry Using Detectors as Transfer Standards	Y Ohno	S
	TC2-39 Geometric Tolerances for Colorimetry	D Rich	J
*	TC2-40 (S) Characterizing the Performance of Illuminance and Luminance Meters	R Rattunde	S
	TC2-42 The Colorimetry of Visual Displays	K. Vassie	J
	TC2-43 Determination of Measurement Uncertainties in Photometry	G Sauter	S
	TC2-44 Vocabulary Matters	J Gardner	J
	TC2-45 Measurement of LEDs - Revision of CIE 127	K Muray	S
*	TC2-46 (S) CIE/ISO Standards on LED Intensity Measurements	J Scarangelo	S
	TC2-47 Characterization and Calibration Methods of UV Radiometers		S
	TC2-48 Spectral Responsivity Measurement of Detectors, Radiometers and Photometers	G Eppeldauer	S
	TC2-49 Photometry of Flashing Light	Y Ohno	V
	TC2-50 Measurement of the Optical Properties of LED Clusters and Arrays	J Schuette	V
	TC2-51 Calibration of Multi-Channel Spectrometers	R Austin	J
	TC2-52 Addendum to CIE 121 for the Photometry of Emergency Lighting Luminaires	G Vandermeersch	V
	TC2-53 Multi-Geometry Color Measurements of Gonio-apparent Materials and Metrics for Evaluation	G Rösler	J
*	TC2-56 (S) CIE/ISO Standard on Retroreflection Measurements	C. Miller	J
*	TC2-57 (S) Revision of CIE S014-2	A Robertson	J
	TC2-58 Measurement of LED Radiance and Luminance	K Kohmoto	S
	TC2-59 Characterisation of Imaging Luminance Measurement Devices	P Blattner	S
	TC2-60 Effect of Instrumental Bandpass Function and Measurement Interval on Spectral Quantities	D Gibbs	S
NEW	TC2-61 Spectral and Colorimetric Electronic Data Exchange	M Pointer	V

\* TCs producing ISO/CIE standards

AD: J- Johnson, S- Sauter, V- Vandermeersch

## Reporterships

	Reporter Title	Reporter	AD
	R2-23 ISO/CIE Standards for the measurement of reflectance and transmittance	D Rich	J
	R2-28 Evaluation of colorimeter spectral responsivity	B Kránicz	S
	R2-32 Visual appearance measurement	M Pointer	J
	R2-33 Measurement of laser-based projection displays	K Niall	S
	R2-34 Methods for characterising and calibrating detectors in photon counting regime	M Rastello	S
NEW	R2-36 Measurement requirements for solid state light sources	G Heidel	S
NEW	R2-37 Industrial lighting requirements for a D65 illuminant	E Pierson	V

## Liaisons

Organization	Liaison Officer
CCPR - Consultative Committee of Photometry and Radiometry	Y Ohno
Division 8	A Kravetz
ISO TC6 Paper, board & pulps	J Zwinkels
IEC TC 34: Lamps and related equipment	G Vandermeersch
ISO on reflectance and transmittance issues	D Rich
IDA (International Dark Sky Association)	J Rennison
OIML (Organization of International Legal Metrology)	G Sauter
IALA (International Association of Lighthouse Authorities)	C Andersen
IEC TC100/TA2 (Color Management and Measurement/Audio, Video and Multimedia Systems and Equipment)	D Rich

## Closed functions

- R2-21 Use of detectors as absolute transfer standards for spectroradiometry
- R2-27 Field Measurement for Traffic Signals
- R2-35 Uncertainties in Distribution Temperature Determination

## New functions established

**TC2-61** Spectral and Colorimetric Electronic Data Exchange

**TR:** To write a Technical Report to define a specification for the electronic communication of spectral and colorimetric data from measuring instruments.

**Chairman:** Mike Pointer (UK)

## **R2-36 Measurement requirements for solid state light sources**

**TR:** To investigate the need for guidelines and recommendations relating to the measurement of LEDs, OLEDs and other solid state light sources that are not covered by other CIE Publications or TCs. Specific aspects to be considered include guidance for production areas, high brightness LEDs (e.g. pulsed operation and temperature control) and detector qualification (f1' etc.).

**Reporter:** Gunther Heidel (Germany)

## **R2-37 Industrial lighting requirements for a D65 illuminant**

**TR:** To investigate the requirement for a specification for a practical D65 source for use in industry, particularly the lighting industry.

**Reporter:** Etienne Pierson (Belgium)

## **Changes of functions**

The title and TR of **TC2-53** have been changed.

New title: Multi-Geometry Color Measurements of Gonio-apparent Materials and Metrics for Evaluation.

New TR: Write recommendations for the color measurement and evaluation of colorimetric properties of gonio-apparent materials.

## **Progress on TC document publication**

CIE Draft Standard DS 014-1.2/E:2004 "Colorimetry - Part 1: CIE Standard Colorimetric Observers": NC comments were closed on 2005-05-15.

CIE Draft Standard DS 014-2.2/E:2004 "Colorimetry - Part 2: CIE Standard Illuminants": NC comments were closed on 2005-05-15.

## **Meetings**

### **1. CIE Midterm, León 2005**

The CIE Midterm meeting / International Lighting Congress "Lighting in the XXI Century" was held on May 18-20, 2005 in León, Spain. Sessions particularly related to Division 2 were Photometry and LED applications. The papers were published in the CD distributed at the conference.

### **2. Division 2 Meeting (17 May 2005)**

The 2005 Division 2 Meeting was held on May 17, 2005 in León, Spain, with 51 attendees from 20 countries, including 13 country members. The minutes of the meeting were compiled by the Secretary, reviewed by DD, and distributed via website in May 2006, and are attached to this Activity Report.

### **3. Technical Committee Meetings (16 & 18 May 2005)**

The following TC meetings took place in conjunction with the 2005 Division 2 Meeting in Leon. Brief reports on these TC meetings are included in the 2005 Division 2 Meeting minutes (attached in this Activity Report).

- TC2-16 Characterisation of the performance of tristimulus colorimeters (J. Schanda)
- TC2-23 Photometry of street-lighting luminaries (G. Vandermeersch)
- TC2-45 Measurement of LEDs - Revision of CIE 127
- TC2-46 CIE/ISO standards on LED intensity measurements (J. Scarangelo)
- TC2-48 Spectral responsivity measurement of detectors, radiometers, and photometers.
- TC2-50 Measurement of the optical properties of LED clusters and arrays
- TC2-53 Multi-geometry color measurements of effect materials (G. Rösler)
- TC2-56 (S) CIE/ISO standard on retroreflection measurements (C. Miller)
- TC2-58 Measurement of LED radiance and luminance
- TC2-59 Characterisation of imaging luminance measurement devices ( P. Blattner)
- TC2-60 Effect of instrumental bandpass function and measurement interval on spectral quantities (D. Gibbs)



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May 31, 2006

### Minutes of 2005 CIE Division 2 Meeting

9:00 – 17:00, 17 May 2005

León, Spain

#### Abbreviations:

AD: Associate Director  
CIE CB: CIE Central Bureau  
CIE BA: CIE Board of Administration  
CM: Country Member  
DD: Division Director  
ILV: International Lighting Vocabulary  
ML: Member List  
NC: National Committee  
TC: Technical Committee  
TCC: Technical Committee Chair  
TR: Terms of Reference  
D2: Division 2 (D1, D4, D8, likewise)  
ST: Status  
WG: Working Group

#### Attendees:

Carl Andersen	FHWA, USA
Petz Anikin	ACOL Technology, Russia
<u>Jean Bastie</u>	BNM-INM/CNAM, <u>France</u> (CIE Vice President)
Rolf Bergman	Consultant, USA (President, CIE-USA)
<u>Peter Blattner</u>	METAS, <u>Switzerland</u>
Gorow Baba	MCRL, Japan
Ellen Carter	Color Research and Appl., USA

<u>Antonio Corrons</u>	IFA, CSIC, <u>Spain</u>
Iakya Couceiro	INMETRO, <u>Brazil</u>
Richard Distl	Instrument Systems, Germany
George Eppeldauer	NIST, USA
<u>Teresa Goodman</u>	NPL, <u>UK</u> (D2 DD)
David Gibbs	NPL, UK
Lan Teng Hai	Lumileds Lighting, Malaysia
Jack Hsia	USA
Chang He Hong	Chonbuk National Univ. Korea
Franz Hengstberger*	CSIR-NML, <u>South Africa</u> (CIE Vice President)
Toni Gugg-Helminger	Gigahertz-Optik, Germany
Günther Heidel	Osram OptoSemiconductor, Germany
Werner Horak	Siemens, Germany
<u>Erkki Ikonen</u>	MIKES, <u>Finland</u>
<u>Nobert Johnson</u>	3M Co., <u>USA</u> (D2 AD)
Jens J. Jensen	DELTA, Denmark
Kohtaro Kohmoto	Teknologue Co., Japan (TC2-50 chair)
Udo Krüger	Techno Team, Germany
Janos Makai	CIECB, Austria
Larry Leetzow	Magnaray, USA
Hans Allan Löfberg*	Univ. Gävle, <u>Sweden</u> (CIE Past President)
Cameron Miller	NIST, USA
Kathleen Muray	INPHORA, USA
Gerald Mathe	Instrument Systems, Germany
Yoshi Ohno	NIST, USA (D2 Secretary)
Seung Nam Park	KRISS, Korea
<u>Etienne Pierson</u>	Laborelec, <u>Belgium</u>
<u>M Luisa Rastello</u>	IEN, <u>Italy</u>
Gerhard Rösler	GretagMacbeth, Germany
<u>Ichiro Saito</u>	NMIJ/AIST, <u>Japan</u>
<u>Georg Sauter</u>	PTB, <u>Germany</u> (D2 AD)
John Scarangelo	Lumileds Lighting, USA
Gennady Shamparunyany	Russia
Janos Schanda*	Univ. Veszprem, <u>Hungary</u> (CIE Secretary)
Jens Schuette	SLI Miniature Lighting, Germany
Hiroshi Shitomi	NMIJ/AIST, Japan
Armin Sperling	PTB, Germany
Walter Steudtner	OSRAM GmbH, Germany
<u>Raissa Stolyarevskaya</u>	Acol Technologia, SA, <u>Russia</u>
Ian Tutt	Trinity House, UK
Guy Vandermeersch	Belgium
Richard Young	Optronic Labs, USA
<u>Joanne Zwinkels</u>	NRC, <u>Canada</u>

Total **51** persons from **20** countries, including **13** country members. Underlines indicate country members. \* proxy for country member.



## **Handouts**

Agenda of 2005 Division 2 meeting (**Attachment 1**)

List of the country members, TCs, Reporterships, and Liaisons.

## **Opening**

Division Director, Teresa Goodman, opened the meeting at 9:00 a.m. and welcomed everyone present.

### **1. Attendance List, Apologies**

Secretary received regrets from the following persons:

George Andor (Hungary)  
Pierre Botha (South Africa)  
Jeanne-Marie Coutin (France)  
Arnold Gaertner (Canada)  
Gyula Dezsi (Hungary)  
Stanko Erste (Slovenia)  
Jim Gardner (Australia), D2 Editor  
Neil Hodson (USA), TC2-32 chair  
Alan Kravetz (USA), D8 liaison  
Balazs Kranicz (Hungary)  
Tore Kolas (Norway) ... Arve Augdal represents  
Tom Larason (USA), TC2-29 chair  
Allan Ottosson (Sweden) ... H. A. Lofberg represents  
Jianguan Pan (China)  
Reiner Rattunde (Germany)  
Danny Rich (USA), TC2-39 chair  
Alan Robertson (Canada), TC2-57 chair  
Christine Wall (UK), TC2-42 chair  
Gan Xu (Singapore)  
Gene Zerlaut (USA), TC2-17 chair

### **2. Introductions**

All participants introduced themselves.

### **3. Approval of Agenda**

The agenda for this meeting was previously distributed via the website (**Attachment 1**). The agenda was approved with no changes.

#### **4. Approval of the 2004 D2 meeting minutes**

The minutes of the 2004 D2 meeting in Tokyo, Japan, which were distributed via e-mail circular and on the website in October 2004, were approved with no changes.

#### **5. Director's Report (T. Goodman)**

First, DD reported the sad news that Mike Marsden (UK), a past president of CIE and CIBSE, passed away very recently. The attendees observed a moment of silence for him. DD then reported several items of news from the Board of Administration meeting as below.

##### ***a) CIE Publications Webshop***

The webshop for CIE publications is nearly ready and will be in operation next month (June 2005). Members of CIE national committee are eligible for a 50 % discount on CIE publications, and this will be highlighted on the website; it is hoped this will attract more people to become CIE NC members. There will be links to national committees on the website. The webshop has been set up at no direct cost to the CIE, but a small percentage of each transaction will be paid to the company who developed the site to cover the development cost. The company also sells publications for other standards bodies, such as ISO and IEC, and CIE receives a payment for each of these publications sold through the CIE webshop portal – CIE members are therefore encouraged to use this route for purchase of all their standards documents.

##### ***b) List of CIE Recommended Journals***

A list of CIE 'recommended journals' is being developed. This is to try to overcome the problem that because many of the key lighting journals, such as Lighting Research and Technology (LR&T), are not listed on the Science Citation Index, researchers in some academic institutions find it unrewarding to publish papers in these journals and instead publish in less relevant journals. As a result, developments in light and lighting are not being disseminated in the most effective manner.

In order to be included on the CIE recommended list, journals will be required to demonstrate that they meet a rigorous set of criteria, such that their standard can be regarded as being at least as high as those journals on the SCI. This will help researchers to justify publication of their papers in these journals. The request to be included in the CIE list should come from the journal itself, after which the necessary information to demonstrate compliance with the assessment criteria will be reviewed by the Publications Board, who will then make a recommendation to the CIE BoA regarding whether the journal should be accepted. The list, and the assessment criteria, will be made available on the CIE website and reported in CIE News on a regular basis. A request for inclusion on the list has already been received from LR&T, and two other journals are also interested. DD requested that, if the participants know of any journals that they think should be on the list, they should contact the editorial board of the journal asking them to approach CIE.

##### ***c) ILV***

The new version of ILV is nearly completed, and is now in the process of harmonization of terms between different Divisions. The ILV will be published in two volumes, a 'Fundamental' and an 'Applications' volume. It will be published in electronic form, with all terms in alphabetical order. The deadline for harmonization is September, when there will be a final vote. The ILV will be published as a CIE version first, but it is expected that it will ultimately be published as a Joint CIE/IEC standard. The details of the process for joint publication is yet to be discussed with IEC. Blattner added that the list of terms contained in the current ILV is available in four languages on the IEC website ([www.iec.ch](http://www.iec.ch)) (but not the definitions of the terms). Kohmoto mentioned that in the IEC version it is expected that there will be translation of the terms in five languages including Japanese and Chinese, and Japan plans to develop an official Japanese version. Goodman clarified that the current plan of CIE is to publish the CIE version only in English. Translation of terms into other languages will be discussed with the IEC. Discussions with IEC will start immediately after this Midterm Session.

***d) Relationship with other organizations***

There will be a new Vice President, Standards, from 2007, whose responsibility is to ensure that CIE's position and expertise are properly recognized in all other standardizing bodies. There will be discussions very quickly (even before he officially takes up this role) to address some specific issues that have already arisen (such as boundaries between UV and visible, which one of the ISO committees has proposed to change).

***e) Future structure of CIE***

There have been discussions in the Board regarding whether CIE is organized in best way, particularly the Division structure. There are potential overlaps between Divisions and some issues do not fit in any of the Divisions. Therefore the Board plans to spend one whole day next year discussing recommendations for potential changes for the future. DD asked for any ideas from participants so she can feed back comments at the discussion. One idea may be to divide CIE activities by horizontal technologies, rather than to split by applications (measurement, vision, exterior lighting etc.)

Vandermeersch commented that IEC has horizontal committees and vertical committees, and we need to mix both. Director's personal view is that it does not matter as long as communication is good.

Andersen raised a concern that this Midterm session did not provide sufficient time to allow communication between Divisions (independent from the wonderful job done by the Spanish NC in organizing the meeting). There should be more time (days) to allow cross-Division participation and discussion. Secretary added that it was not possible to schedule all TC meetings in one day. DD will raise this at the next Board meeting.

***f) Future meetings***

Dates for the next Quadrennial Session, in Beijing, China, have now been set: 4th to 11th of July 2007. The deadline for abstracts will be 15 September 2006.

Several symposia are planned for next year that Div.2 members may find of interest:

- **Jan 2006:** Centennial of IESNA, NY
- **Feb. 2006:** Lighting Research Organization (USA), Symposium on communicating color information to consumers, in Florida
- **May 2006:** CIE Symposium at NRC, Canada to celebrate 75<sup>th</sup> Anniversary of CIE Colorimetric Observer functions
- **June 2006:** CIE Symposium on Uncertainty, Braunschweig, Germany (organized by D2)
- **Sep. 2006:** 2<sup>nd</sup> CIE Symposium on Light and Health, at NRC
- **Sep. 2006:** CIE Symposium on the Measurement of Appearance, in Paris
- **Sep. 2006:** Hellenic Institute workshop on night landscape (night light pollution) in Greece.

***g) CIE Colorimetry Book***

CIE is celebrating the 75<sup>th</sup> anniversary of the 1931 System of Colorimetry and will publish a book “CIE Colorimetry 1931 – 2006” to commemorate this. Schanda explained that the book will include chapters on history, fundamentals of colorimetry in CIE 15:2004, spectral color measurement, tristimulus colorimetry, uncertainty in color measurement, physiologically-based colorimetry, color difference metrics, color appearance models, image analysis, color management, and future prospects. Schanda asked for any further ideas. The book will have to be prepared during the next few months to be in time for the Symposium in May 2006.

**6. Secretary’s Report (Y. Ohno)**

Country Members: D2 now has 36 country members. The country representative of South Africa has changed (to Pierre Botha) since the last D2 meeting.

Reports Issued: The Summary of the 2004 D2 meeting (Tokyo, Japan) was distributed via e-mail circular in Sep. 2004. The Minutes of the D2 Tokyo meeting were distributed in October 2004. The Activity Report – May 2005 was produced and distributed in May 2005. These documents are also posted on the D2 website.

Division 2 Mailing List: The List now has ~190 persons (last year – 187). The e-mail addresses are maintained on the email reflector. The list is always kept updated as far as possible. Currently 183 persons have valid e-mail addresses on the list. All communications in D2 are done by e-mail (reflector) and through the website, except for a few country members who have no e-mail access. The Secretary requested that everyone should inform him any changes of e-mail address as they occur, to ensure that they continue to receive circulars. The Secretary reminded the meeting that e-mail addresses are not shown on the D2 website (for security purposes), and they are available at a link provided at the end of D2 home page, username cie2 (the password is the name of the city where CIE CB is located).

D2 Website: It has been updated constantly. There have been no major changes in structure. There are currently 17 TC drafts posted on the website (password protected). The TC status is updated every year on the TC page. The global password is distributed only to CMs and

TC chairs, and password for each individual TC is provided for use in the TC. Those who have lost the password can contact Secretary or TCC to receive it.

E-mail reflectors: cie-d2@nist.gov continues to serve for D2 circulars and other communications. The Secretary reminded the meeting that any messages other than from the subscribers are all blocked, to avoid spams. An archive of all the past messages is available at a link provided at the end of D2 home page (the same password as subscriber list). The TC e-mail reflectors are provided to allow discussions on TC drafts etc., between physical meetings. Currently, reflectors are set up for TC2-29, 2-45, 2-46, 2-48, and 2-50. Subscriber lists and message archives are available in the same way as with cie-d2 reflector. TC email reflectors are created on a by request basis. TC chairs who need a reflector should contact Secretary.

DD Goodman encouraged everyone to use the website and TC email reflectors for discussion between physical meetings, and asked all TC chairs to make sure they have the latest TC draft posted on the website. DD also emphasized that, in spite of the high level security system of e-mail server, spams do come through, often disguised as being from one of our members (for example, the ones that came recently under her name had not been sent by her). She urged everyone to be cautious.

Finally, DD Goodman expressed her thanks for the continuing hard work done by Secretary. This was strongly endorsed by all present.

## **7. Editor's Report**

The Secretary received a report from the Editor, Jim Gardner. The following two draft standards have undergone final editing (with input from DD, Secretary and Mielenz), in response to comments from the NC ballots:

- CIE DS 010 Photometry - The CIE System of Physical Photometry (work of TC 2-35, "CIE Standard for  $V(\lambda)$  and  $V'(\lambda)$ ") (This standard was published as ISO 23539:2005(E)/CIE S010/E:2004 Photometry –The CIE System of Physical Photometry, in September 2005.)
- CIE DS 014-2.2 Colorimetry - Part 2: CIE Standard Illuminants (work of CIE TC 2-33, "Reformulation of CIE Standard Illuminants A and D65"). The revised version is out for NC comment.

The Editor also assisted TC2-39 by providing comments on draft Technical Report of the TC, on request from the Chair, Danny Rich. He also reviewed documents from TC2-37 and TC2-45.

The Editor also worked on finalizing the D2 part of the ILV, in response to comments at Tokyo meeting. The details are reported in TC2-44 report.

It was mentioned that Editor is working fast and efficiently and his work is much appreciated.

## **8. Progress Reports from Technical Committees, Reporters, and Liaison Persons**

### **8.1. Associate Director Johnson and TC chairpersons**

Reports on TCs 2- 17, 19, 25, 28, 32, 39, 42, 44, 51, 53, 56, 57 were given.

### **8.2. Associate Director Sauter and TC chairpersons**

Reports on TCs 2-16, 29, 37, 40, 43, 45, 46, 47, 48, 58, 59, 60 were given.

### **8.3. Associate Director Vandermeersch and TC chairpersons**

Reports on TCs 2-23, 49, 50, 52 were given.

The reports given for 8.1, 8.2 and 8.3 are summarized below in the numerical order of all the TCs.

#### **TC2-16** Characterization of the performance of tristimulus colorimeters

**Chair:** J. Schanda (Hungary)

**AD:** Sauter

**ML:** Bittar (New Zealand), Denner (South Africa), Goodman (UK), Gundlach (Germany), Hengstberger (South Africa), Moore (UK), Murray (USA), Ohno (USA), Oleari (Italy), Pointer (UK), Rastello (Italy), Rattunde (Germany), Sakai (Japan), Sauter (Germany), Sugiyama (Japan), Terstiege (Germany)<sup>†</sup> – revised Nov. 2005.

**TR:** To produce a report recommending methods for assessing the performance of tristimulus colorimeter heads for measuring chromaticity coordinates.

**ST:** AD Sauter reported for the TCC. The TCC changed last year from Rastello to Schanda. The 11<sup>th</sup> draft was discussed chapter by chapter at the meeting on 16 May 2005 and participants agreed on minor changes to be made in the final draft. The TC agreed that Draft 12 will be sent for TC ballot, and if accepted, to Divisional and BA ballot.

#### **TC2-17** Recommendation for integrated irradiance and spectral distribution of simulated solar radiation

**Chair:** G. Zerlaut (USA)

**AD:** Johnson

**ML:** Chomiczewski (USA), Cordo (USA), DePietro (USA), Ellersick (USA), Christiaens (France), Grossman (USA), Gueymard (USA), Ketola (USA), Martin (USA), Myers (USA), Riedl (Germany), Robbins III (USA), Schoenlein (Germany), Scott (USA), Severon (Germany) – revised March 2006.

**TR:** Revise and update CIE Publication No.20 (1972)

**ST:** Bergman reported for the TCC. A key objective of the TC is to use the SMARTS2 solar radiation model (developed by Gueymard) to establish new tables of spectral energy distributions which can be used as references for the simulation of solar radiation for specific applications. A rationale for updating CIE 85 has been prepared, based on a comparison of SMARTS2 and CIE 85. There was a meeting of US interests on January 25, 2005 in Ft. Lauderdale, FL. The TCC proposes a meeting in Europe in the third quarter of 2005.

**Discussion:** Schanda commented that this TC should be aware of the activity of TC1-66 (indoor daylight spectral distribution for colorimetry), which is focused on the effects of window materials and requests from an ISO committee, and should make sure the results of the two TCs are not in conflict. DD Goodman suggested that the TC should also liaise with work in Div. 3 related to indoor daylight solar distribution. Hengstberger commented that the international daylight measurement program is also

running in Div. 3. He also suggested that revising CIE 85 might have implications for other existing CIE publications (on solar simulators, spectral distributions of skies, etc.), which should be considered. Distl mentioned that pulsed solar simulator sources are now used for testing solar cells, so these should also be considered. Sperling commented that some work at PTB on spectral responsivity of solar cells using a pulsed solar simulator has been published.

#### **TC2-19** Measurement of the Spectral Coefficient of Retroreflection

**Chair:** N. Johnson (USA)

**AD:** Johnson

**ML:** Arens (USA), Brekke (Norway), Fisher (USA), Hsia (USA), Hubert (France), Kurioka (Japan), Price (UK), Rendu (France), Rennilson (USA), Richey (Germany), Schreiber (Germany), Sugiyama (Japan), Terstiege (Germany), Vandermeersch (Belgium)

**TR:** Identify the critical measurement parameters, tolerances, and requirements for, and conduct an international intercomparison of, the spectral coefficient of retroreflection.

**ST:** TCC Johnson reported. The TC report on the intercomparison of spectral coefficient of retroreflection is almost finished. The last annex on radiometers is to be added and it will then be ready to send to the Editor, prior to TC ballot.

#### **TC2-23** Photometry of Street-Lighting Luminaires

**Chair:** G. Vandermeersch (Belgium)

**AD:** Vandermeersch

**TR:** Prepare a technical report on the photometry of street lighting luminaires.

**ML:** Arens (USA), Blaser (Switzerland), Blochouse (Belgium), Claassens (NL), Corrons (Spain), Price (UK), Rattunde (Germany), Rossi (Italy), Simons (UK), Sorensen (Denmark)

**ST:** TCC Vandermeersch reported. The TC met on 16 May 2005 to discuss the work plan for preparation of technical report on specific requirements for goniophotometry of street light luminaires, which will be published as an addendum to CIE 121. In preparation for the meeting, the TCC and the TC secretary Blochouse reviewed CIE 121 to determine which sections need to be amended, and prepared a draft 2-page addendum document. This addresses issues relating to description of the mounting position (tilt) of the luminaire and the presentation of measurement data according to the format recommended in CIE 140.

The TC also discussed the need for guidance relating to the correct measurement of TL5 lamps, due to issues relating to temperature, and with regard to whether or not a ballast lumen factor correction should be applied for LOR measurements. Work on these points is currently being handled by an informal group of three manufacturers and two laboratories in Europe, in which the TCC is participating. It appears that CIE 121 may need to be revised to give specific guidance on these issues. Hengstberger suggested that, if the TC is intending to extend its work to include a revision of CIE 121, the TR should be changed. Goodman proposed that this TC (without changing the TR) could be closed next year when the addendum is adopted, and a new TC then set up to revise 121 to address the issue of TL5 lamps and BLF correction. This approach was agreed.

## **TC2-25 Calibration Methods and Photoluminescent Standard for Total Radiance Factor Measurement**

**Chair:** J. Zwinkels (Canada)

**AD:** Johnson

**ML:** Bristow (Sweden), Erb (Germany), Leland (USA), McCamy (USA), Nayatani (Japan), Puebla (Germany), Racz (Hungary), Simon (USA), Witt (Germany), Clarke (UK) - revised Aug. 2002

**TR:** Prepare a CIE report on methods for measurement of total radiance factor of photoluminescent materials. Recommendations for realizing and calibrating photoluminescent standards by the one and two-monochromator methods will be included.

**ST:** TCC Zwinkels reported. The document was sent for TC ballot just before the San Diego meeting (2004) and was unanimously approved, with some editorial comments. These comments have now been incorporated into a revised draft. In addition, with the assistance of the Editor and Secretary, some further editorial changes have been made in order to harmonize the new terms for fluorescence defined in the document with those defined in TC1-53 (spectral quality of daylight simulators; published last year). The new terms on fluorescence defined in the document have also been sent to the Editor for review for submission to the ILV.

Since all the changes made to the draft voted on by the TC are editorial in nature, it was agreed by all present that the revised document should now proceed directly to Division ballot.

## **TC2-28 Methods of characterizing spectrophotometers**

**Chair:** Mike Pointer (UK)

**AD:** Johnson

**ML:** Andor (Hungary), Bastie (France), Berns (USA), Distl (Germany), Eckerle (USA), Konstantinova (Bulgaria), McCamy (USA), Robertson (Canada), Sugiyama (Japan), Ulyanov (Russia), Zwinkels (Canada)

**TR:** Write a CIE report on the characterization of spectrophotometers by means of reference materials and other methods, with particular reference to linearity, wavelength error, stray light, and integrating sphere errors.

**ST:** DD Goodman reported for the TCC. The former TCC, Peter Clarke left NPL last year and Pointer took over the chairmanship. Draft 5 has been completed and sent to the TC. Some comments were received and most of these have now been incorporated into a revised draft. There are only one or two issues in the uncertainty section and some terminology updates still to be completed. It is expected that the report should be sent for final TC ballot within the next year.

## **TC2-29 Measurement of Detector Linearity**

**Chair:** T. Larason (USA)

**AD:** Sauter

**ML:** Bastie (France), Clare (New Zealand), Distl (Germany), Eppeldauer (USA), Goodman (UK), Webb (USA), Palmer (US), Sauter (Germany), Andor (Hungary), Bittar (New Zealand), Budde (Canada), Dezsi (Hungary), Mihailov (Russia), Moestl (Germany) - July 2003 (being updated)

**TR:** Prepare a CIE guide on methods for the characterization of the linearity of detectors of optical radiation, including different principles by which the linearity of detectors can



be determined and causes of non-linear behavior, to aid users of optical radiation detectors in the selection and use suitable devices for specific applications.

**ST:** Ohno reported for the TCC. Work has been delayed and no progress has been possible on the next draft due to the TCC's schedule. However it is planned to make the changes agreed upon at the San Diego meeting, and to receive further comments from the committee members, by October 2005 (via the email reflector). A meeting may be held at a suitable time and location (e.g. CIE D2 Meeting at PTB in June 2006).

#### **TC2-32 Measuring Retroreflectance of Wet Horizontal Road Markings**

**Chair:** N. Hodson (USA)

**AD:** Johnson

**ML:** Austin (USA), Davies (USA), Dibbern (Germany), Hubert (France), Johnson (USA), Lundkvistl (Sweden), Meydan (Australia), Meseberg (Germany), Rennilson (USA), Schmidt-Clausen (Germany), Schnell (USA), Schreuder (Netherlands), Soardo (Italy), Sorenson (Denmark) - revised August 1999

**TR:** To prepare a guide for the methods of measuring coefficient of retroreflected luminance (specific luminance) of horizontal road markings under wet weather conditions.

**ST:** AD Johnson reported for the TCC. The TC draft is close to completion. One section of technical document remains to be finalized and some additional figures added. Once this section is finished the document will be sent to the Editor and for TC ballot. It was noted that good liaison is being maintained with D4, due to their interest in this topic.

#### **TC2-37 Photometry Using Detectors as Transfer Standards**

**Chair:** Y. Ohno (USA)

**AD:** Sauter

**ML:** Andor (Hungary), Austin (USA), Bastie (France), Bittar (New Zealand), Czibula (Germany), Corrons (Spain), Dézsi (Hungary), Eppeldauer (USA), Gardner (Australia), Goodman (UK), Kohler (BIPM), Moore (Great Britain), Muray (USA), Pietrzykowski (Poland), Rattunde (Germany), Rastello (Italy), Sauter (Germany), Schanda (Hungary), Wychorski (USA)

**TR:** To prepare a report on the properties of  $V(\lambda)$ -corrected detectors that are suitable for disseminating and maintaining photometric units. This report will include methods for the use of these detectors.

**ST:** TCC Ohno reported. A TC ballot on the draft 7 was held in June 2004 and several comments (mostly editorial) were received. There were no negative votes. The TCC is working on a revised draft incorporating these changes and will send this to TC members as soon as it is ready, in preparation for the final version for Division ballot.

#### **TC2-39 Geometric Tolerances for Colorimetry**

**Chair:** D. Rich (USA)

**AD:** Johnson

**ML:** Baba (Japan), Bittar (New Zealand), Decarreau (France), Fisch (USA), Hanssen (USA), Jordan (Canada), Johnson (USA), Kravetz (USA), Ladson (USA), Terstiege (Germany), Pietrzykowski (Poland), Verrill (UK), Zwinkels (Canada). Consulting member: Erb (Germany). - revised June 1999.

**TR:** Compile a technical report and recommendations specifying the geometric tolerances for the various geometries in colorimetry, including 0/45, 0/d and others. Parts of this

technical report may be suitable for inclusion in a CIE standard specifying several geometric tolerance levels.

**ST:** AD Johnson reported for the TCC. The document was approved as a result of the TC ballot, and has now been sent to the Editor. The Secretary reported that he had received the document from TCC, but it still needed minor editorial work. Once these editorial changes are completed, the document will be sent for Division ballot.

DD Goodman mentioned that TC2-53 would be very interested in this document and suggested they look at it before the Division ballot. Schanda suggested that since TC1-57 (Robertson) is developing standards on colorimetry, they should also be sent a copy.

#### **TC2-40** Characterizing the Performance of Illuminance and Luminance Meters

**Chair:** R. Rattunde (Germany) **AD:** Sauter

**ML:** Austin (USA), Bastie (France), Czibula (Germany), Dezsi (Hungary), Goodman (UK), Khandelwal (India), Khanh (Germany), Mahidharia (India), Moore (UK), Ohno (USA), Pietrzykowski (Poland), Saito (Japan), Sauter (Germany), Stolyarevskaya (Russia), Xu (Singapore), Ye (China) – revised July 1999

**TR:** Convert the present CIE Technical Report No. 69 into an ISO/IEC standard. Prepare a combined CIE/ISO standard describing the definitions of quantities influencing the performance of illuminance and luminance meters, as well as defining measurement procedures for the individual error quantities.

**ST:** No report received. There has been no progress of the TC since Warsaw (1999). DD Goodman suggested that she should contact the TCC and request a new draft within three months. If there is no response, a new TCC should be identified. Sperling showed interest in taking over the chairmanship if necessary.

#### **TC2-42** Colorimetric Measurements for Visual Displays

**Chair:** C. Wall (UK) **AD:** Johnson

**ML:** Andor (Hungary), Ansell (USA), Baribeau (Canada), Berns (USA), Boyton (USA), Dalton (UK), Hanson (UK), Hardis (USA), Ikeda (Japan), Lara (USA), Laur (Germany), Leone (USA), Lindfors (Finland), Luo (UK), MacDonald (UK), Maelfeyt (Belgium), McFadden (Canada), Ohno (USA), Rastello (Italy), Reid (UK), Sakai (Japan), Schanda (Hungary), Stienstra (Netherlands), Stokes (USA), Vienot (France) – revised June 2001

**TR:** To produce a Technical Report summarizing recommended practice for the measurement of the colorimetric and spectroradiometric properties of visual displays.

**ST:** DD Goodman reported for TCC. A TC meeting was held 3 years ago and the document was fairly close to completion. However, the TCC's responsibilities have changed and she can no longer continue the work. DD suggested Ken Vassie at NPL, who is responsible for display measurement, would be willing to take over. There were no other volunteers from participants, so this was agreed. DD will therefore ask Ken Vassie to take over the TC with the hope that he can finish the document within a year or so. AD Johnson noted that coordination with D8 is important for this TC.

**TC2-43** Determination of measurement uncertainties in photometry.

**Chair:** G. Sauter (Germany)

**AD:** Sauter

**ML:** Bastie (France), Corrons (Spain), Daubach (USA), Ellis (USA), Gaertner (Canada), Goodman (UK), Moore (UK), Ohno (USA) - Aug. 2002

**TR:** To prepare a CIE recommendation as the basis for the determination of measurement uncertainties valid for selected quantities used in photometry.

**ST:** TCC Sauter reported. The document is ready except for the question of whether weighted fits should be used for distribution temperature, which is dependent on the conclusion from the reportership (R2-35, Robertson) created at Tokyo meeting. Once this is resolved, the document will be ready to send to the Editor and for TC ballot.

**TC2-44** Vocabulary Matters

**Chair:** J. Gardner (Australia)

**ML:** Billmeyer (USA), Burghout (Netherlands), Ionescu (Romania), Johnson (USA), Kohler (BIPM), Morren (Belgium), Nishi (Japan), Ohno (USA), Poppe (Hungary), Sauter (Germany), Schanda (Hungary), Woo (Canada)

**TR:** To provide liaison between D2 and TC 7-06 "Lighting Terminology" and support the preparation of the new edition of the International Lighting Vocabulary in the field of light and colour measurements.

**ST:** The Secretary received a written report from the Editor. Several terms that had been under discussion within D2, and that were discussed at the Tokyo meeting in 2004, were sent to the ILV committee as agreed by D2. A few items which generated further questions were held-over for further discussion, and deemed too late to be resolved in time for the coming revision. Some inconsistencies in revised terms from the different Divisions were raised, and harmonization efforts took place by email discussions between Schanda, Editor, DD2, and Secretary. Once the current ILV revision is complete, the next revision will not be processed for some years. The Editor proposes that this TC should continue, but not with fixed members. He suggests that efforts for future revisions of the ILV should focus on new terms that are established during the work of TCs. These will be approved when new TC documents are submitted for Division ballot. If any issues or conflicts of terms are raised during the ballot, a discussion should be generated within the Division by e-mail, with all interested parties able to participate, in order to reach agreement. The TC 2-44 Chair (i.e. Editor) will be responsible for collating all new terms ready for when the next revision of the ILV takes place.

AD Johnson suggested that the members of the TC that created the terms should become temporary members of TC2-44 when the relevant terms are discussed. DD supported the Editor's suggestion to use email and the email reflector for the discussion, as it proved highly effective for recent discussions relating to the definition of radiance. Hengstberger emphasized that the focus of the committee should be on new terms and that it should not to re-open discussion of definitions of previously agreed terms unless absolutely essential.

#### **TC2-45 Measurement of LEDs - Revision of CIE 127**

**Chair:** K. Muray (USA)

**AD:** Sauter

**ML:** Austin (USA), Bando (Japan), Balta (USA), Berkhout (USA), Bouman (Netherlands), Budzinski (South Africa), Bym (USA), Carr (USA), Distl (Germany), Ellis (USA), Fleischer (USA), Gan (Singapore), Goodman (UK), Halkin (Belgium), Heidel (Germany), Jones (USA), Kohmoto (Japan), Larsen (Denmark), Marchl (Germany), Moore (UK), Myers (USA), Ohno (USA), Rastello (Italy), Sauter (Germany), Scarangelo (USA), Schanda (Hungary), Solomon (Taiwan), Stolyarevskaya (Russia), Webb (USA), Young (USA) – July 2000.

**TR:** Revise CIE Pub. 127 to include improved definitions of quantities and methods of measurement for total flux and partial flux of LEDs and to re-evaluate other parts including spectral and color measurements of LEDs.

**ST:** TCC Muray reported. A TC meeting was held in Leon on 16 May 2005. Prior to the meeting Draft 5 had been distributed to TC members and to the Editor, who edited the document. Several comments were received and minor changes to a few paragraphs were discussed at the meeting. Three members will send revised paragraphs within two weeks. The document will then be sent for TC ballot.

#### **TC2-46 CIE/ISO standards on LED intensity measurements**

**Chair:** J. Scarangelo (USA)

**AD:** Sauter

**ML:** Angerstein (Germany), Bando (Japan), Bouman (Netherlands), Bym (USA), Carr (USA), Distl (Germany), Ellis (USA), Goodman (UK), Heidel (Germany), Hwang (Taiwan), Jones (USA), Lester (USA), Moore (UK), Ohno (USA), Rastello (Italy), Sauter (Germany), Scarangelo (USA), Schanda (Hungary), Schumacher (Germany)

**TR:** To prepare a CIE/ISO standard on the measurement of LED intensity measurements based on the CIE Pub. 127.

**ST:** TCC Scarangelo reported. The TCC prepared a new draft (Draft 6), which was simplified from the previous draft, as agreed at the last TC meeting. This will be reviewed at the TC meeting in Leon on 18 May 2005.

After the D2 meeting, Secretary received a TC meeting report as below:

The TC met in Leon in May 2005 and reviewed the sixth draft document, specifically focusing on scope, definitions, specific tolerances, uncertainty calculation, and detector description sections. With respect to scope, TC discussed including multiple chip or lens LEDs that are within the size limit scope. On definitions, it was decided to remove acceptance angles, allow mechanical axis and case temperature point to be defined by the LED vendors, consider a "spectral intensity" definition, and in general not include items like Tc or Tp, if they are defined elsewhere. On tolerances, it was tentatively decided that tolerances are not needed, because this is a measurement standard, and not an equipment standard. However, a section on uncertainty calculation should be added with help from committee members to write it. On detector descriptions, TC decided to just drop the detector appendix since the standard is mainly a measurement definition and not a guide.

#### **TC2-47 Characterization and Calibration Methods of UV Radiometers**

**Chair:** open

**AD:** Sauter

**ML:** Boivin (Canada), Hengstberger (South Africa), Wilkinson (Australia), Lambe (UK), Rattunde (Germany), Saunders (USA), Pietrzykowski (Poland), Corrons (Spain), Larason (USA), Thompson (USA), Kohmoto (Japan), McArthur (Canada), Kravetz (USA) - Aug. 2002

**TR:** Prepare a CIE recommendation on methods of characterization and calibration of broad-band UV radiometers in the spectral ranges of UVA and UVB for industrial applications.

**ST:** The former chairman, Gan Xu, resigned before Tokyo meeting in 2004. DD Goodman tried to find someone from NPL, but was not successful. There were no volunteers from the attendees. DD will try to approach someone from Finland. A fairly complete draft exists so there will not be much work needed to complete this TC.

#### **TC2-48** Spectral responsivity measurement of detectors, radiometers, and photometers

**Chair:** G. Eppeldauer (USA)

**AD:** Sauter

**ML:** Austin (USA), Boivin (Canada), Bouman (USA), Corrons (Spain), Coutin (France), Dezsi (Hungary), Gardner (Australia), Goodman (UK), Köhler (BIPM), Larason (USA), Larsen (Denmark), McArthur (Canada), Ohkubo (Japan), Palmer (USA), Pietrzykowski (Poland), Rattunde (Germany), Saito (Japan), Sauter (Germany), Webb (USA), Xu (Singapore), Schanda (Hungary).

**TR:** To rewrite the technical report CIE 64 (1984) "Determination of the spectral responsivity of optical radiation detectors" to update device and measurement technology, and include the spectral irradiance and radiance responsivity measurement for radiometers and photometers from UV to near IR.

**ST:** Ohno reported for the TCC. The TCC prepared the 7<sup>th</sup> draft, which included all the planned chapters, and distributed this to TC members in April. This draft was discussed at the TC meeting in Leon on 16 May 2005. No major issues arose. The final part of the document (on monochromators) will probably be moved to an Appendix and the section on bandpass correction will be re-examined in relation to work in TC2-60. After these changes are made, the draft will be close to a TC ballot. The next meeting is planned for Braunschweig in 2006.

#### **TC2-49** Photometry of Flashing Light

**Chair:** Y. Ohno (USA)

**AD:** Vandermeersch

**ML:** Andersen (USA), Arens (USA), Austin (USA), Berkhout (USA), Couzin (USA), Ellis (USA), Eppeldauer (USA), Fedai (USA), Fryc (Hungary), Gibbs (UK), Goodman (UK), Hengstberger (South Africa), King (USA), Kohler (BIPM), Kondo (Japan), Rattunde (Germany), Rennilson (USA), Sagawa (Japan), Schmidt-Clausen (Germany), Sauter (Germany), Tutt (UK), Vienot (France), Webb (USA) – April 2003.

**TR:** Produce a technical report for photometric measurements of flashing light, including derivation of the photometric quantities applied to flashing light, measurement of light sources, and calibration of photometers for flashing light.

**ST:** TCC Ohno reported. The current draft document contains four methods. It had been planned to standardize on one method for measuring effective intensity, but little progress has been made recently due to lack of visual experimental data to provide a solid basis for the recommendation. A 1986 paper by US Coast Guard was found, which reported vision experiments on trains of pulses at different intervals, which

agree well with Modified Allard results. NIST now has a post-doc vision scientist in their staff and expecting to start a vision science project where experiments on effective intensity are planned. On the other hand, TCC is also preparing to make a progress on the draft report without waiting for further experimental data.

Tutt commented that having different results from different methods is a problem, and said that improved methods such as Modified Allard may be preferred for new flashing light technologies such as those using pulsed LEDs. Hengstberger supported the TCC's intention to move forward on the draft without waiting for input from D1, which has been requested for a long time, and suggested that existing data should be reviewed.

**TC2-50** Measurement of the optical properties of LED clusters and arrays

**Chair:** G. Schuette (Germany)

**AD:** Vandermeersch

**ML:** Ashdown (USA), Sperling (Germany), Gibbs (UK), Ikonen (Finland), Distl (Germany), Goodman (UK), Hai (Malaysia), Heidel (Germany), Kohmoto (Japan), Mathe (Germany), Muray (USA), Ohno (USA), Pan (China), Rattunde (Germany), Navvab (USA), Sauter (Germany), Steudtner (Germany), Scarangelo (USA), Stolyarevskaya (Russia), Young (USA) – revised May 2005

**TR:** To produce a technical report for the measurement of optical properties of visible LED arrays and clusters, to derive optical quantities for large LED arrays and recommendations for measurement methods and conditions.

**ST:** AD Sauter reported for the TCC. The TC met in Leon on 16 May 2005, attended by 18 members and 18 guests. Schuette took over as TCC after the last meeting in Tokyo. Email reflector was set up in March 2005. The first draft (Draft 1a, not complete) was distributed prior to the Leon meeting. The TC discussed scope, terminology, and two issues: 1) operating modes and 2) luminous intensity measurement. It was agreed that normal far-field luminous intensity measurement will be included, as will continuous and modulated operation modes, but that flashing light (covered by TC 2-49) and asynchronous pulses shall be excluded. The TCC asked for inputs from members, and hopes to update drafts before next meeting in Braunschweig in 2006.

**TC2-51** Calibration of multi-channel spectrometers

**Chair:** R. Austin (USA)

**AD:** Johnson

**ML:** Goodman (UK), Hopkinson (UK), Prince (UK), Pietrzykowski (Poland), Smith (USA), Bergman (USA)

**TR:** Produce a technical report for the calibration of array spectroradiometers primarily for the determination of colorimetric and photometric quantities, including sources of error in array spectral measurements systems, evaluation of these errors, calibration methods and methods for the determination of uncertainty. (Revised in 2003)

**ST:** No report received this time. AD Johnson to contact TCC on the status of this TC.

**TC2-52** Addendum to CIE 121 for the Photometry of Emergency Lighting Luminaires

**Chair:** G. Vandermeersch (Belgium)

**AD:** Vandermeersch

**ML:** Corrons (Spain), Ottosson (Sweden), Rattunde (Germany), Stratford (UK), Weiss (Germany), Bedocs (UK), Rossi (Italy), Price (UK, until 1/3/2003), Arens (USA, until 1/1/2002) - updated July 2003

**TR:** To produce an addendum to CIE publication 121 containing specific requirements for the photometry of emergency lighting luminaires, in particular to provide additional correction factors on the relative output of the luminaires at specified times of operation.

**ST:** TCC Vandermeersch reported. The draft document is in its final stages. The work is being coordinated with work by the Emergency Lighting Panel of IEC34: the IEC recommendations cover what to measure (these have now been finalized and are under national vote) and the CIE document covers how the measurements should be made. The IEC recommendations introduced a new parameter, emergency ballast lumen factor (EBLF), which is very low, near 10%, and varies in time due to changes in battery output. They also consider dynamic behavior of the lamp in the first 15 seconds.

### **TC2-53 Multi-Geometry Color Measurements of Effect Materials**

**Chair:** G. Roesler (Germany)

**AD:** Johnson

**ML:** Pointer (UK), Naddal (USA), Pietrzykowski (Poland), Andor (HU), Rastello (Italy), Gunde (SI), Fryc (Poland), Rodrigues (USA), Nofi (USA), Rich (USA), Dauser (Germany), Gabel (Germany), Cramer (Germany), Baba (Japan), Carter (USA), VanAken (USA) - April 2003

**TR:** Write recommendations for the color measurement of effect materials.

Workplan: (i) Comparison of the DIN and ASTM standards on Multigeometry color measurement; (ii) Preparation of an educational section to combine most interests; (iii) Recommendations from the educational section for the next meeting.

**ST:** TCC Roesler reported. The TC met in Leon on 16 May 2005. It was proposed to change the title and TR, since the meaning of “effect materials” was thought to be unclear. The proposed new title is: “Multi-Geometry Color Measurements of Gonio-apparent Materials and Metrics for Evaluation.” and new TR are: “Write recommendations for the color measurement and evaluation of colorimetric properties of gonio-apparent materials”; these were agreed by the D2 meeting with no objections. The TC also proposes to use notation of measurement angles relative to normal (according to the general practice in CIE), while ASTM uses notation of 0 to 180 degrees; there is potential for serious confusion. The TC also proposes to introduce aspecular (AS) angle (angle relative to specular reflection angle) for measurement.

A substantial discussion followed. Johnson suggested that consistency is important with CIE 15 and the TC2-39 document. He also noted a similar case (observation angle) in retroreflection measurement defining specific angles for given applications. DD proposed that she would write a letter to ASTM (prior to the next ASTM meeting in June 2005) requesting them to adopt CIE recommended definitions for the angle notation. D2 agreed to her proposal.

### **TC 2-56 (S) CIE/ISO standard on retroreflection measurements**

**Chair:** C. Miller (USA)

**AD:** Johnson

**ML:** Johnson (USA), Stratford (UK), Jenkins (Australia), Sorenson (Denmark), Rastello (Italy), Ledoux (France), Frank (Germany)

**TR:** To prepare a CIE/ISO standard on the measurement of retroreflective materials based

on CIE Publication 54.2

**ST:** Andersen reported for the TCC. The TC met in Leon on 16 May 2005, prior to which the TCC had completed Draft 1 and distributed it to TC members for review. The TC noted that there were some issues in CIE 54 that need to be looked at more closely and discussed the need to ensure that definitions are correct, since this is a standard and should be the point of reference for definitions. Based on the comments at the meeting, the TCC plans to revise the draft within a few months and have more complete draft ready by the next D2 meeting.

**TC2-57 (S) Revision of CIE S014-2**

**Chair:** A. Robertson (Canada)

**AD Johnson**

**ML:** Bristow (Sweden), McGinley (Austria), Zwinkels (Canada), Rich (USA), Schanda (Hungary), Pointer (UK), Hirschler (Hungary), Ohno (USA) – updated May 2005

**TR:** To revise CIE Standard S014-2 (Colorimetry Part 2: CIE Standard Illuminants) to include Illuminant D50.

**ST:** Zwinkels reported for TCC. The TC was established at the 2003 D2 meeting in San Diego on the understanding that it would not start work until the current revision of S014-2 was completed. The latest draft of this current revision (CIE DS 014-2.2/E:2004) has been approved by the CIE BA and CIE Division 2 and has been submitted to all CIE NCs for comments with a deadline of 2005-05-15. Once final approval is achieved, TC 2-57 will begin its work.

**TC2-58 Measurement of LED radiance and luminance**

**Chair:** K. Kohmoto (Japan)

**AD Sauter**

**ML:** Horak (Germany), Sliney (USA), Muray (USA), Goodman (UK), Ohno (US) + others to be agreed

**TR:** To prepare a CIE Technical Report setting out recommended measurement methods for the luminance and radiance of LEDs, taking particular account of the specific requirements of relevant photobiological safety standards

**ST:** TCC Kohmoto reported. There will be a TC meeting on May 18, 2005 in Leon. The TCC looked into a new commercial luminance meter designed to measure small size sources, and experimentally measured the luminance of several LEDs. The data will be presented and discussed.

After the D2 meeting, Secretary received a TC meeting report as below:

“In succession to discussion at the 1<sup>st</sup> Meeting held in Tokyo, experimental measuring methods of LED luminance were investigated. Among them, actual measured results of conventional LEDs with a new commercial luminance meter were introduced. Luminance of both 5 mm oval type LEDs and Chip on Board (COB) type LEDs (color: white, blue, green and red) were measured by using the luminance meter with close up lens. Actual measured values of luminance on the surface of LED chip (white type) were over 300 kcd/m<sup>2</sup> (for oval) and over 600 kcd/m<sup>2</sup> (for COB). Applicable procedure of these measured values to photobiological safety evaluation were discussed. It could be recognized that it will become more important to specify clearly measured area on LED chip for photobiological hazard evaluation.”



## **TC2-59 Characterisation of Imaging Luminance Measurement Devices**

**Chair:** P. Blattner (Switzerland)

**AD:** Sauter

**ML:** To be finalised

**TR:** To prepare a Technical Report on methods for the characterization of imaging luminance measurement devices.

**ST:** TCC Blattner reported. The TCC distributed two working documents (WG01 references, WD02 Basic considerations) in April 2005. These were reviewed by the TC at its first meeting in Leon on 16 May 2005, and the proposed structure of the report and the terms and vocabulary were discussed. The TC agreed to focus first on luminance, later on color or filtered-radiometric measurement. The TC will first look at characterization parameters in Pubs. 69 and 53, and then discuss additional parameters specific to imaging photometers. The TCC asked members for contributions to the document. The next meeting is planned for Braunschweig in 2006.

## **TC2-60 Effect of Instrumental Bandpass Function and Measurement Interval on Spectral Quantities**

**Chair:** D. Gibbs (UK)

**AD:** Sauter

**ML:** Guenther (Germany), Ohno (USA), Robertson (Canada), Saito (Japan), Sauter (Germany), Schanda (Hungary), Sperling (Germany), Steudtner (Germany), Kohmoto (Japan), Hai (Malaysia), Zwinkels (Canada), Bastie (France), Scarangelo (USA), Young (USA), Woolliams (UK), Goodman (UK) – Feb. 2006

**TR:** To prepare a technical report that describes the effect of instrumental bandpass functions and measurement wavelength interval on spectrally resolved quantities and provide recommendations on suitable methods to minimize the error introduced by instrumental bandpass functions on spectrally integrated or weighted quantities.

**ST:** TCC Gibbs reported. The TC had its first meeting in Leon on 16 May 2005 at which the TR were reviewed. It was agreed that the scope should include spectroradiometry of sources, spectrophotometry of materials, and spectral responsivity of detectors. Methods of correction of bandpass will be included for both mechanical scanning instruments and array spectrometers. The draft layout of the report was discussed and agreed with no objections. Ohno presented his new method for correction of bandpass (presented at AIC'05 in Granada) and will send the spreadsheet for this method to committee members. The TCC plans to circulate a first draft later this year, and have next TC meeting in June 2006.

## **8.4 Reporters**

### **R2-21 Use of detectors as absolute transfer standards for spectroradiometry**

**Reporter:** N. Fox (UK)

**AD:** Sauter

**TR:** To review the potential use of absolutely calibrated spectroradiometers as transfer standards

**ST:** DD Goodman reported. There are some developments but technology is not moving as quickly as anticipated. DD proposes to close this reportership and will ask the reporter to produce a report summarizing his conclusions, to be possibly included in the CIE collection. D2 agreed to close this reportership with no objection.

**R2-23 ISO/CIE Standards for the measurement of reflectance and Transmittance**

**Reporter:** D. Rich (USA)

**AD:** Johnson

**TR:** To investigate the need for converting the CIE technical report on reflectance and transmittance measurement (CIE 130) to a joint ISO/CIE standard

**ST:** No report received this time.

**R2-27 Field Measurement for Traffic Signals**

**Reporter:** C. Andersen (USA)

**AD:** Vandermeersch

**TR:** To assess the need for a TC to produce recommendations on field measurements for traffic signals, in particular those using LED arrays.

**ST:** AD Vandermeersch reported. The reporter proposes to close this reportership, as he does not think a recommendation can be developed until we have correct metrology for measurement of LED modules. The reporter will provide a written report later. D2 agreed to close this reportership with no objection.

**R2-28 Evaluation of Colorimeter Spectral Responsivity**

**Reporter:** B. Kranicz (Hungary)

**AD:** Sauter

**TR:** To review new methods for assessing the ‘quality-of-fit’ of the spectral responsivity of colorimeters, particularly for use with new sources such as LEDs.

**ST:** No report received. AD Sauter to contact the reporter.

**R2-32 Visual Appearance Measurement**

**Reporter:** M. Pointer (UK)

**AD:** Johnson

**TR:** To monitor the work of Divison 1 on visual appearance measurement, which will include potential new measurement areas

**ST:** DD Goodman reported. There is a TC on this subject in D1 and the reporter is working as a liaison with D2. (This has been established as a reportership rather than a liaison activity because it is on a specific topic.) TC1-65 now has 24 members. A copy of a National Physical Laboratory Report “Measuring Visual Appearance – A Framework for the Future” was circulated to TC members for informal comment in 2004. The response was favourable and the report has now been reformatted to form a draft CIE Technical Report. Some changes from the original document were necessary – in particular, some of the sections were reduced in length or detail. The draft Technical Report was circulated to the TC members in January 2005 with a request for comments by the end of April 2005. 15 members responded: 2 approved the report as it stood and 13 submitted comments, some quite considerable. The report will now be modified in the light of these comments and then resubmitted for Committee ballot.

See **Attachment 2** for the full report from M. Pointer. The second meeting of the Technical Committee is being held on 17 May 2005 in León.

**R2-33 Measurement of Laser-Based Projection Displays**

**Reporter:** K. Niall (Canada)

**AD:** Sauter

**TR:** To describe concepts and methods of photometry for the comparison of laser-based projection displays.

**ST:** No report received. AD Sauter to contact the reporter.

## **R2-34 Methods for Characterising and Calibrating Detectors in Photon Counting Regime**

**Reporter:** M. L. Rastello (Italy)

**AD:** Sauter

**TR:** To consider the emerging requirements for characterisation and calibration of detectors in the photon counting regime.

**ST:** Rastello reported. This reportership was established in 2002. Much work is in progress in this area. There was a workshop on single photon technology at NIST in 2003 with large attendance. A 2<sup>nd</sup> workshop on the same topic is planned at NPL for October 2005. The reporter plans to have a conclusion on this reportership at the next D2 meeting.

## **R2-35 Uncertainties in Distribution Temperature Determination**

**Reporter:** A. Robertson

**TR:** To investigate the potential effect of a change to the definition of distribution temperature to include a statement regarding weighting the spectral distribution values by the uncertainty of the measurements at each wavelength.

**ST:** Ohno reported. Secretary received a written report from the reporter, which is posted on the website. This is a 3-page report, which explains the background of the problem discussed last year during the TC2-43 meeting and D2 meeting. The report highlights that weighting the spectral distribution data by the measurement uncertainty yields different results to those obtained using unweighted data. The recommendation of this Reporter is that, even though the use of weights may be justified from a theoretical statistical point of view, weights should not be used in practice because they can introduce small errors in certain common situations. See **Attachment 3** for the full report from the reporter. This reportership will be closed.

## **8.5. Liaisons with other Divisions**

### **Division 8 (A. Kravetz)**

Ohno read a written report from Kravetz: The following Technical Reports have been published:

- CIE 159:2004 from TC 8-01: A Colour Appearance Model for Colour Management Systems (CIECAM02). This TC will open a Reportership to follow the activities and then close.
- CIE 156:2004 from TC 8-03: Guidelines for the Evaluation of Gamut Mapping Algorithms.
- CIE 162:2004 from TC 8-04: Chromatic Adaptation Under Mixed Illumination Condition When Comparing Softcopy and Hardcopy Images. This TC will open a Reportership to follow the activities and then close.

TC 8-05 Criteria for the Evaluation of extended – Gamut Color Encodings is being balloted; deadline is 5/5/05.

TC 8 -08 is considering changing its terms of reference pending a review of developing algorithms.

## **8.6 Liaisons with other organizations**

### **CCPR - Comité Consultatif de Photométrie et Radiométrie (Y. Ohno)**

Ohno reported. CCPR Working Groups met in May 2004 at NIST. The next CCPR meeting and WG meetings are scheduled for October 2005 in Paris, immediately after the NEWRAD conference. Several Key Comparisons are in progress:

***Spectral irradiance CCPR K1a:*** Draft A has been distributed, which showed much improvement compared with the comparison carried out in 1991.

***Aperture comparison CCPR S2:*** Draft A is near completion at NIST.

Hengstberger, the President of CCPR, added that the WG on Calibration and Measurement Capability (CMC) met for the first time last year. Members of this WG are RMO P&R TC representatives rather than NMIs. This WG discusses service categories and measurement capabilities that NMIs declare. CMCs are now fairly complete (available at BIPM website) and will be maintained. The Working Group on UV (Chair: Ikonen) is discussing a pilot comparison in vacuum UV below 200 nm.

Hengstberger also mentioned that a document is being drawn up to define the relationship between CIE and CCPR, and that the SI brochure being prepared by CIPM will include a section on photobiological quantities and includes input from CIE.

Further details on Key comparisons and CCPR activities are available at <http://www.bipm.org>.

### **ISO TC6/WG3 Paper, board & pulps – optical properties (J. Zwinkels)**

Zwinkels reported. This ISO WG will hold the next meeting in June 2005 in Stockholm. Items to be discussed include: new convener for WG3, new work item with ISO TC130 on visual appearance properties, and a proposal for an ISO Standard for measurement of D65 brightness resulting in two ISO standards for measuring this quantity (indoor and outdoor illumination conditions). This WG is also responsible for standards for specular gloss. There are three standards, two for 75° geometry (converging beam geometry and collimated beam geometry), and one for 20° geometry. The terminology does not agree with the CIE vocabulary. There is also confusion regarding the definition of the wavelength (air or vacuum) in the primary gloss standard. One of the planned actions is to review the terminology with Pub. 17.4.

### **IEC TC34 Lamps and related equipment (G. Vandermeersch)**

Vandermeersch reported. “Related equipment” includes ballasts and luminaires. This is an active committee, meeting two times a year, for a week each time. The TC’s main concern is electrical safety of equipment. The TC published a new standard for DC supply HF electronic ballast for emergency lighting (IEC 1346-7). At a recent meeting in Spain, the TC discussed revising the document related to self-contained emergency luminaires.

### **ISO on reflectance and transmittance issues (D. Rich)**

Ohno reported for Rich. ISO TC 130: New work items are being proposed for revisions to ISO 3664 on sources for visual evaluation of graphic images and to ISO 13655 on the measurement of directional diffuse reflectance factor (45:0) for the measurement of reflectance of printed graphic images. In both cases, without direction from Division 2 on

the measurement of fluorescent materials, the ISO will be recommending the use of instrument sources without UV content to try minimize the impact of fluorescent whitening agents on the color of the ink on the whitened substrate.

**IDA (J. Rennilson)**

No report received. Larry Leetzow mentioned that information is available at the IDA website.

**OIML (G. Sauter)**

Sauter reported. There are no issues to be reported this time. Keep this function open.

**IALA (International Association of Lighthouse Authorities) (C. Andersen/ I. Tutt)**

Tutt reported. There was an IALA Workshop on lights and batteries in Dublin in 2004 that discussed recent developments in light sources and power sources. One of the outcomes was a need for input from CIE on uncertainty evaluation. IALA is also looking for standardization in the method to determine effective intensity and looking for progress in TC2-49. This is increasing in importance due to the use of pulsed LED clusters. IALA is working on draft recommendations on emergency markings for wrecks and for buoys with blue/yellow alternating light. DD suggested that she would write to IALA welcoming their interest in CIE and the work being carried out towards the development of an effective intensity metric.

**IEC TC100 (Color measurement and management in multimedia systems) (D. Rich)**

Ohno received a report from Rich. There have been no changes in the IEC standards with respect to the measurement of light. There have been new standards issued that document supplementary device-dependent color spaces.

## **9. Proposals for dissolution of TCs and reporterships**

No TCs were proposed for closure. Closure of the following reporterships was approved with no objections.

R2-21 Use of detectors as absolute transfer standards for spectroradiometry

R2-27 Field Measurement for Traffic Signals

R2-35 Uncertainties in Distribution Temperature Determination

## **10. Proposals for new TCs and reporterships**

(1) Proposal by Mike Pointer.

There is a strong demand from manufacturers and users to have an open, standardized format to communicate spectral and colorimetric data electronically. This was discussed in the Colour Measurement Committee (CMC) of the Society of Dyers and Colourists and a Focussed Interest Group of the National Physical Laboratory, and they already have a draft specification and demonstration software. The need for a standard was first proposed to ISO130 but, because this is a generic issue rather than just for textiles, they suggested it should be a joint ISO/CIE standard. The current specification is mostly for materials but it

could include spectroradiometry also. See a more detailed written proposal from Pointer (**Attachment 4**). After a long discussion, D2 agreed to establish this TC to write a technical report first, rather than moving straight to a standard. The new TC was subsequently agreed by the Board as follows:

**TC2-61 Spectral and Colorimetric Electronic Data Exchange**

TR: To write a Technical Report to define a specification for the electronic communication of spectral and colorimetric data from measuring instruments.

Chairman: Mike Pointer (UK)

Initial members: Elsie Coetzee (ZA), Robert Dornan (UK), Peter Rhodes (UK), Gerhard Roesler (DE), Richard Young (US), Michal Vik (CZ)

**(2) Proposal by K. Muray**

TC2-45 is finalizing its work on revision of CIE 127 in order to publish it without further delay, but there are some remaining issues that will not be covered in the revision. Muray suggests that a new TC needs to be formed to address such issues as measurements in production control, operating conditions for high-power LEDs (including pulsed operation and other thermal control), and photometer spectral responsivity qualification. Comments were made that it is also necessary to look at other LED TCs and investigate what other aspects are not covered, e.g., OLEDs. D2 agreed to establish a reportership to prepare the TR and scope of the new TC for the next meeting. The reporter is Guenther Heidel (but TC2-45 members should support him.)

**R2-36 Measurement requirements for solid state light sources**

TR: To investigate the need for guidelines and recommendations relating to the measurement of LEDs, OLEDs and other solid state light sources that are not covered by other CIE Publications or TCs. Specific aspects to be considered include guidance for production areas, high brightness LEDs (e.g. pulsed operation and temperature control) and detector qualification (f1' etc.).

Reporter: Gunther Heidel

**(3) Proposal by DD Goodman**

DD received a letter from a D6 member who saw an article in a photobiology journal, which described stray light correction for measurement for UV sunbeds (280 – 400 nm), giving the impression that this correction is a trivial matter. The letter suggested CIE should consider this matter and send a short note to the journal to warn readers that it is a difficult procedure. DD asked whether we need a specific action on this or whether it can be handled in TC-51. Several comments were made, e.g., whether it is good to give just a warning without providing a solution or recommendation, whether just one journal is enough, etc. After lengthy discussion with no clear consensus, DD suggested that she would talk with D6 and the Board members to see what they suggest, and will also consult with D2 people before preparing an article for any journal, if this is decided to be the best solution.

**(4) Proposal by E. Pierson**

Pierson raised a need for recommendation on practical realization of a D65 source. This has also been discussed in D1 since no recommendation is given in CIE15:2004 for a physical D65 source. This is needed not only for colorimetry but also other applications such as measurement of phantom effects for signals, which requires a high power D65 simulated source. Zwinkels commented that she had a reportership in D1 some time ago, looking at feasibility of such recommendation as there were approaches using filters. A TC was later set up, chaired by Robert Herschler, but the direction of the TC went more towards assessing daylight simulators. There are two publications in Appl. Opt. on a D65 simulation source based on a xenon lamp. A comment was made that high power source to simulate daylight is also needed in the photovoltaic area. D2 agreed to establish a reportership on this subject as follows:

**R2-37 Industrial lighting requirements for a D65 illuminant**

TR: To investigate the requirement for a specification for a practical D65 source for use in industry, particularly the lighting industry.

Reporter: Etienne Pierson (BE)

(5) Changes to TCs, reporterships, and liaison functions.

No changes on liaison functions.

Changes of title and TR in TC2-53 have been agreed – see TC report.

## **11. General issues (DD Goodman)**

### **11.1. New Director for Division 2**

Goodman's second term as DD will end in 2007, and a new DD will need to be appointed at that time. To start the process, DD will send an email to all the D2 members asking for nominations for the director. A vote (Country Members only) will then be held. DD announced that the D2 Secretary, Ohno, would be happy to be nominated. It was also mentioned that CIE BA would like to have a list of candidates of at least two names.

### **11.2. Future D2 Symposia**

- (1) 2<sup>nd</sup> CIE Symposium on Measurement Uncertainty, 12-16 June 2006, hosted by PTB, Braunschweig, as agreed in Tokyo. There will be a Tutorial and Workshop, combined with D2 meetings and Interlumen (a meeting of German lighting society). It was mentioned that there is a conflict of dates with ASTM E12 in June. AD Johnson to check and look for possible solution. Sperling mentioned that the dates of symposium and D2 meetings are not changeable because hotel pre-booking cannot be changed due to the football World Cup.
- (2) Follow-on symposia on LED measurements. A suggestion was made to have it with Quadrennial in China, but many thought it would make it too long. This is to be discussed again at the next D2 meeting.
- (3) Follow-on symposium on pulsed source and temporal aspects. No definite plan yet – to be discussed again at the next D2 meeting.

## **11.2. Future Directions for Measurement R&D**

DD feels that the Division needs to be more pro-active and identify measurement issues before they become problems. The following items were discussed from the list of last year:

- Source spectral measurement outside the current range of 200 nm to 2500 nm. This is particularly related to safety requirements, where there is a specific need for measurements up to 3000 nm.
- Measurement of OLEDs. This may be a reportership in the near future.
- Smart paper. This is more a topic for D8.
- Characterization of fiber optics as a component of spectroradiometers.
- Measurement in the mesopic range. There will be a symposium on May 21, 2006 in Leon. Keep watching the progress in D1.

New items discussed

- Near-field goniophotometry, for luminaries and extended SSL sources (E. Pierson)
- Hyperspectral imaging – spectral measurement in 2-dimensions (R. Young)
- EU project (iMERA) aimed at supporting research and development in metrology, which needs to be watched (Sauter). Further details to be available next year (Rastello). A liaison activity may be set up.
- EU Directive on maximum optical radiation exposure for workers (A. Gugg-Helminger). This relates to photobiological safety (D6) and possibly measurement requirements. The draft standard is available on the website ([http://europa.eu.int/eur-lex/lex/LexUriServ/site/en/oj/2006/l\\_114/l\\_11420060427en00380059.pdf](http://europa.eu.int/eur-lex/lex/LexUriServ/site/en/oj/2006/l_114/l_11420060427en00380059.pdf))
- IEC TC76 (laser safety) has a new draft document 60825-23. There are concerns in CIE and IEC on the photobiological safety of LEDs, which are currently included in the IEC laser safety standard as well as the CIE standard for photobiological safety of lamps (Blattner). Discussions are being held with IEC to try to harmonize the recommendations to avoid confusion. Werner Horak is leading this activity.
- Absolute methods for photometric measurement (Kohmoto).

## **12. Future D2 Meetings:**

**2006** June 14-16 in Braunschweig, following the Uncertainty symposium.

**2007** July 9-11, with Quadrennial Session in Beijing, China

**2008** An offer has been made by IEN, Italy, for 2008 (joint meeting of D1 and D2). Another possibility is with NEWRAD 2008. To be discussed next year.

## **13. Any Other Business**

No further issues were raised.

## **14. Adjournment**

The Division 2 meeting adjourned at 5:00 PM.



- Attachment 1** Agenda of 2005 Div.2 Meeting  
**Attachment 2** Report of R2-32 Visual Appearance Measurement (M. Pointer)  
**Attachment 3** Report of R2-35 Uncertainty in Distribution Temperature (Robertson)  
**Attachment 4** Proposal: Electronic Communication of Colour Information (Pointer)

# 2005 Division 2 Meeting

León, Spain  
09:00, 17 May 2005

## Agenda

1. Attendance list, apologies
2. Introductions
3. Approval of agenda
4. Approval of the minutes of 2004 Division meeting
5. Director's report
6. Secretary's report
7. Editor's report
8. Progress reports from Technical Committees, reporters and liaison persons
  - 8.1. Associate Director Johnson and TC chairpersons
  - 8.2. Associate Director Sauter and TC chairpersons
  - 8.3. Associate Director Vandermeersch and TC chairpersons
  - 8.4. Reporters
  - 8.5. Liaisons with other Divisions
  - 8.6. Liaisons with other Organisations
9. Proposals for dissolution of TCs and reporterships
10. Proposals for new TCs and reporterships
11. General issues
  - 11.1 Next Director for Division 2
  - 11.2 Future D2 Symposia
  - 11.3 Future directions for measurement R&D
12. Future meetings
  - 12.1 2006
  - 12.2 2007
  - 12.3 2008
13. Any other business
- 14. Adjournment**

## **Attachment 2**

### **R2-32 Visual Appearance Measurement**

May 2005

**Established:** San Diego, June 2003

**Reporter:** Mike Pointer GB

#### **Approved Terms of Reference**

To monitor the work of Division 1 on visual appearance measurement which will include potential new measurement areas.

The work in Division 1 is in TC 1-65 Visual appearance measurement.

#### **Introduction**

A possible aim of "appearance" measurement is the development of a software tool that allows an evaluation of the visual perception of a product based on physical measurements. Ultimately this could lead to development of an instrument that can perform the tasks of a human observer in real-time for a wide range of types of products and complex surfaces, evaluating colour, gloss, pattern, surface texture, etc.

TC 1-65 will seek to establish the basic elements of a framework to aid the development of a suitable measurement regime. It will require a review of existing techniques and their suitability to isolate the requirements for the development of mathematical and software tools to identify a key minimum set of measurands required, coupled with (and based on) real-time measurement of physical characteristics and visual assessments.

#### **Suggested Work Programme**

1. To produce a technical report describing a suitable framework for the measurement of visual appearance.
2. To consider the establishment of separate Technical Committees to work on specific aspects of visual appearance measurement, e.g. gloss, translucency.
3. The whole question of terminology needs to be addressed – the present International Lighting Vocabulary does not include many terms associated with appearance. We need to work with ASTM (ASTM Method E284 *Standard Terminology of Appearance*) to achieve harmony with CIE and get the necessary terms into future editions of the ILV.
4. To produce a list of available instruments that could support the various elements of the framework.
5. To produce a list of academic, and other research institutions that are working on aspects of the framework.
6. To consider the publication of case studies that show individual applications of appearance measurement.
7. To encourage participation from industry in the work of refining the framework and building measurement procedures that relate to appearance.

**Report**

The TC now has 24 members.

A copy of a National Physical Laboratory Report (Measuring Visual Appearance – A Framework for the Future) had been circulated to TC members for informal comment in 2004. The response was favourable and so the report has now been reformatted to form a draft CIE Technical Report. Some changes were necessary – some of the sections were reduced in length or detail.

This draft Technical Report was circulated to the TC members in January 2005 with a request for comments by the end of April 2005. 15 members responded: 2 approved the report as it stood and 13 submitted comments, some quite considerable.

The report will now be modified in the light of these comments and then resubmitted for Committee ballot.

**Meeting**

The second meeting of the Technical Committee is being held on Tuesday 17<sup>th</sup> May in León, Spain.

Dr Mike Pointer GB

**Reporter R2-23**

May 2005

## Attachment 3

### R2-35 Uncertainties in Distribution Temperature Determination

*Report to CIE Division 2, 17 May 2005*

Alan Robertson

National Research Council

Ottawa, Canada

#### Terms of Reference

To investigate the potential effect of a change to the definition of distribution temperature to include a statement regarding weighting the spectral distribution values by the uncertainty of the measurements at each wavelength.

#### Background

Radiation from an incandescent tungsten filament lamp typically has a relative spectral distribution very similar to that of a blackbody radiator. Thus, it is convenient and useful in practice to describe the distribution by a single number, the temperature of the closest blackbody distribution. The most common implementation of this concept is correlated colour temperature, which is defined as the temperature of the blackbody whose colour is closest to that of the test radiation. However, in some applications, the quantity distribution temperature is more useful. Distribution temperature is the temperature of the blackbody radiator whose relative spectral distribution is closest to that of the test radiation. This is a physical definition that is useful in applications that do not involve vision and colour.

The precise definition recommended by the CIE in Publication 114/4-1994 is:

The distribution temperature of a source in a given wavelength range,  $\lambda_1$  to  $\lambda_2$ , is the temperature,  $T_D$ , of the Planckian radiator for which the following integral is minimized by adjustment of  $a$  and  $T$ :

$$\int_{\lambda_2}^{\lambda_1} [1 - S_t(\lambda) / a S_b(\lambda, T)]^2 d\lambda \quad (1)$$

where  $\lambda$  is the wavelength,  $S_t(\lambda)$  is the relative spectral distribution of the radiation being considered,  $S_b(\lambda, T)$  is the relative spectral distribution of the Planckian radiator at temperature  $T$ , and  $a$  is a scaling factor.

#### Issue

During the meeting of TC 2-43 (Determination of measurement uncertainties in photometry) held on 9 June 2004, the TCC (Sauter, DE) proposed that uncertainties of the spectral values should be considered in the calculation of distribution temperature; i.e., the differences between two curves should be weighted by the inverse square of the uncertainty value of each point in order to obtain the best estimate based on statistical theory. Ohno (US) raised a concern that this would be a change of the definition given in

CIE 114/4, and that, if this change was recommended, it would be possible to obtain two different answers from the same spectral data, depending on whether weight is applied or not. This would cause serious confusion. Robertson (CA) commented that the definition should not change because, in a definition, each quantity should be assumed to have zero uncertainty. However, he added that it might be logical to take account of the uncertainties when calculating the best estimate of distribution temperature based on real measured data. This would mean that the definition would remain unchanged but that the recommended calculation method would be to minimize a modified integral:

$$\int_{\lambda_2}^{\lambda_1} \frac{1}{u_{st,rel}^2(\lambda)} \left[ 1 - \frac{S_t(\lambda)}{aS_b(\lambda, T)} \right]^2 d\lambda \quad (2)$$

where  $u_{st,rel}(\lambda)$  is the relative standard uncertainty of the measurement of  $S_t(\lambda)$ .

As in most photometric calculations, the integral would normally be approximated by summation at equal wavelength intervals:

$$\sum_{i=1, n} [1 - S_{t,i} / aS_{b,i}(T)]^2 \quad (3)$$

for the unweighted expression (1), and

$$\sum_{i=1}^n \frac{1}{u_{st,rel,i}^2} \left[ 1 - \frac{S_{t,i}}{aS_{b,i}(T)} \right]^2 \quad (4)$$

for the weighted expression (2).

However, in the D2 meeting on 11 June 2004, Ohno pointed out that this method would yield errors in certain common situations. He showed a simulation involving a common situation in which  $S(\lambda)$  followed a blackbody curve for wavelengths greater than 450 nm but fell below the blackbody for wavelengths less than 450 nm. Using the unweighted expression (3), the distribution temperature of this source is slightly less than that of the blackbody that it follows above 450 nm. However, because, in most spectroradiometric systems, the uncertainty of measurement is greater at low wavelengths (400 to 450 nm) than it is in most of the visible spectrum, the deviations from a blackbody will be given less weight by expression (4), resulting in a distribution temperature that is closer to that of the underlying blackbody. Thus, use of expression (4) leads to an error. Such errors will occur whenever the measurement uncertainty is greater in spectral regions where a source deviates from a blackbody distribution than it is in other regions.

## Discussion

It has been suggested that the “GUM” (the 1993 ISO Guide to the Expression of Uncertainty in Measurement) requires that weights be used. However, this Reporter can find no such requirement in the GUM and notes, as an analogy, that in the analysis of key comparisons conducted under the CIPM MRA, both weighted and unweighted means have been used depending on specific attributes of the comparison.

Two points support the contention that weights should not be used in the calculation of

distribution temperature:

1. The idea behind the concept of distribution temperature is that it provides a single number that can be used to specify a spectral power distribution. This implies that all parts of the spectrum should be treated equally and that no parts should be “penalized” because of characteristics of particular measurement techniques.
2. A fundamental principle of metrology is that a measurand should be defined in such a way that its value does not depend on the method of measurement. The use of weights in the definition or the recommended calculation method would contradict this principle.

### **Recommendation**

The recommendation of this Reporter is that, even though the use of weights, as in expression (4), may be justified from a theoretical statistical point of view, weights should not be used in practice because they can introduce small errors in certain common situations.

## **Attachment 4**

Proposal to CIE D2 – May 2005

WG12 Electronic Communication of Colour Information (joint with NPL)

Chair: Robert Dornan, Secretary: Peter Rhodes, NPL Facilitator: Mike Pointer (was Peter Clarke).

WG12 is a joint working group between the Colour Measurement Committee (CMC) of the Society of Dyers and Colourists and a Focussed Interest Group of the National Physical Laboratory. It was charged with writing a procedure that could lead to a standard for the electronic interchange of data between various measuring instruments.

This Group has essentially finished its work in that a specification has been produced and demonstration software written. Because the original request for the work to be done came from the textile industry, the specification was presented to ISO TC38 Textiles with a request that it be considered as a new work item leading to an ISO Standard. At a meeting in June 2005, this request was rejected because it did not come via the relevant national committee, i.e. via BSI. BSI is similarly reluctant to progress the matter because there is not the apparent support from 5 ISO member countries! It was also felt that the work had a more generic application than just to textiles.

After discussion at the CMC meeting it was suggested (by me) that a way forward might be to establish a CIE Technical Committee with a view to producing a CIE/ISO Standard. This will essentially fast track the process and at least serve to get international recognition that the specification is available.

Thus I propose, at the CIE Division 2 meeting in Leon, Spain, in May, to propose the establishment of a Technical Committee.

Title:

**Spectral and Colorimetric Electronic Data Interchange**

Terms of Reference:

**To write a CIE/ISO Standard to define a specification for  
the electronic communication of spectral and colorimetric data.**

The rationale behind the proposal is that there is a strong demand from manufacturers and retailers dealing with global suppliers, each using different hardware and software, to communicate spectral and colorimetric data electronically. At present the flow of information is not well supported resulting in much colour exchange being done either by manually e-mailing colorimetric data or by posting physical samples. Current electronic formats are system specific.

The proposed colorimetric data exchange format is non-proprietary and XML based. XML has the advantages of being ASCII text based, a widely accepted standard in the Internet world and perfectly suited to defining structured data objects. These data will include the



actual measured spectral data together with a series of tags to define the meta-data associated with the measurement; for example, the sample type, the instrument type, the instrument geometry, the spectral range, the start and end wavelengths, etc. It will also be possible to include colorimetric data from a colorimeter with its own set of meta-data.

The NPL/SDC Group has finished its task in that the specification is defined, written up and a set of examples is available in written form – these could form formative annexe to the standard. I have a concern that they are not written in a format that complies with that required by CIE/ISO and I am not sure that I know how this translation will be effected.

I would request that as many members of the joint working group should become members of the TC, certainly Robert Dornan, Peter Rhodes and Peter Clarke. We will also need at least 4 other international members to get the proposal off the ground.

Mike Pointer  
17-May-2005